

process, making additional regulatory changes impractical at least until that process is complete.

Implementing a transition may also be difficult in spectrum bands that are currently shared with the federal government, because the Commission cannot regulate federal spectrum uses, and the presence of federal users in such bands may limit the benefits of any flexibility that would be afforded to non-federal spectrum users. However, the Task Force recommends consideration of these bands for transition purposes to the extent that transition would be beneficial, and recommends that the Commission work with NTIA to consider alternatives for introducing greater flexibility and efficiency into federal government uses of spectrum.

In bands that fall outside these categories, the Task Force recommends that the Commission initiate proceedings to begin the transition of its spectrum regulations to allow more flexible uses. Moreover, in the long term, the Commission should consider transitioning to a flexible rights model in all bands throughout the spectrum where such action would further the Commission's spectrum policy goals.

2. Available Transition Mechanisms

Once the Commission identifies particular bands that are suitable for transition, it will need to identify appropriate transition mechanisms. Historically, the Commission has used a number of different transitional mechanisms to move spectrum from narrowly-defined legacy uses to more flexible new uses. In addition, other mechanisms that have not previously been used are also available. Generally, the core issue for all of these transition mechanisms is the treatment of incumbents: Do they remain in the band or are they cleared or relocated? If incumbents are cleared or relocated out of the band, what mechanisms are used? If incumbents remain in the band, does the Commission grant them expanded rights outright or does it use a new licensing vehicle to award expanded rights?

Transition options generally fall into the following categories, though variations and combinations of each are also possible: **(1)** reallocating a particular band to the flexible rights model, with assignment of the expanded rights to new licensees and the mandatory relocation of incumbents to other bands; **(2)** allowing incumbents to remain as licensees for those portions in a band that they currently occupy, while assigning "overlay" licenses for additional rights and/or unoccupied "white space" not assigned to incumbents; **(3)** reallocating and assigning spectrum to new licensees under the flexible rights model, and using voluntary market-based band-restructuring incentives, such as a two-sided auction, to encourage incumbents to clear or restructure the band; or **(4)** granting expanded, flexible rights to the incumbent licensees already occupying the band. Each of these options is discussed in general below.

a) Expanded rights “overlay” licenses combined with mandatory relocation of incumbents

Under this option, the Commission reallocates a particular band of spectrum to allow for more flexible uses, grants the expanded usage rights under new licenses (generally via auctions) and requires incumbent licensees and the services they provide to clear the band and either cease operating or relocate to other bands. The Commission has used this option in several instances, including broadband PCS.

There are several variations of this option, depending on the conditions that must be met in order for mandatory relocation of incumbents to occur. Under one approach (which was used for broadband PCS), new spectrum licenses are issued under flexible rules while incumbents are required to clear, relocate, or retune to alternative bands by a specified date. In addition, the new licensees may be required to pay the costs of relocating incumbents. Under a more conditional approach (which was adopted for 700 MHz DTV spectrum), incumbents are required to clear or relocate only if and when certain external conditions are met, such that there is no fixed time frame for clearing and relocation. Under this approach, while new licensees are not required to pay the costs of clearing and relocating incumbents, they may pay for voluntary early clearing by incumbents.

b) Expanded rights “overlay” licenses combined with grandfathering of incumbents

Under this option, the Commission grants expanded usage rights under new licenses, which are “overlaid” on top of the incumbent licenses. Incumbents retain their existing rights (including interference and renewal rights) on a grandfathered basis, and are not subject to mandatory band-clearing or relocation.

The overlay option has been used in services such as paging and SMR where the Commission is converting from site-based to geographic-area licensing, there is unlicensed “white space” (geographic areas where incumbents are not currently authorized), and incumbent and potential new uses are generally compatible. Under this option, incumbents can only acquire expanded rights, including the ability to expand their systems beyond their existing site-based contours, by obtaining overlay licenses. Alternatively, new overlay licensees must protect incumbents’ existing systems unless they buy the incumbents out.

c) Expanded rights “overlay” licenses combined with voluntary band-clearing/restructuring incentives for incumbents

Under this option, the Commission reallocates restricted spectrum to more flexible use, grants the expanded usage rights under new licenses, and establishes a simultaneous market-based exchange mechanism to encourage voluntary band-clearing or restructuring of the band by incumbents. This mechanism is designed to create incentives for incumbents either to relinquish their licenses and clear the band for new users or to exchange their restricted-use licenses for the expanded rights available under the new license.

The Commission has not employed this option to date, but a number of potential mechanisms have been proposed that could facilitate this type of exchange. For instance, one mechanism that has been suggested is a “two-sided” auction, in which the Commission would auction expanded usage rights to spectrum under new licenses, and incumbents would voluntarily make their spectrum rights in the band available for auction at the same time. Under this approach, incumbents would be eligible to participate in the auction for expanded rights only if they offered their own spectrum licenses for sale in the same auction. Moreover, incumbents would be allowed to “bid” on their own spectrum in addition to spectrum offered by other incumbents and by the FCC. Incumbents who chose not to offer their licenses would retain their incumbent rights, but would not be granted expanded rights. This mechanism provides several incentives to incumbents to offer their spectrum rights for possible exchange. First, if incumbents voluntarily participate, they would immediately have their licenses converted to expanded flexible rights licenses, thus increasing the value of their spectrum usage rights. In addition, incumbents would not be forced to sell their spectrum usage rights to others, although they would face the opportunity cost of not doing so. Finally, incumbents would be able to keep any proceeds from the sale of their rights to others, and could, as well, potentially obtain rights to relocate to other parts of the auctioned band (or other bands altogether) that might be more advantageous to them.

d) Expanded rights granted to incumbent licensees under existing licenses

Under this option, the Commission grants expanded flexible rights directly to incumbents through modification of their existing licenses. Potential new entrants are not able to bid for or otherwise obtain these expanded rights, except by acquiring the licenses from incumbents through the secondary market. This option has been used by the Commission in several bands. For example, in the CMRS Flexibility proceeding, the Commission granted CMRS providers the right to provide fixed in addition to mobile services under their existing licenses.

3. Factors Affecting the Choice of Transition Mechanism

The Commission must consider a number of factors when deciding which transition mechanisms to implement. These factors may vary significantly from band to band, suggesting possible advantages to taking different approaches in different bands.

Major factors in the Commission’s evaluation of options include:

- The restrictive nature of licensee rights currently afforded incumbents in the band when compared with the flexibility that would be gained by transitioning to an expanded flexible rights model;
- The types of services currently offered in the band and the potential consumer impact of transitioning to an expanded flexible rights model of licensing;
- The number of incumbents in the band;

- The likelihood that expanded flexibility would lead to rapid changes in the use of the band or instead would have only a gradual impact on existing systems and uses;
- The practical effect on incumbent systems of providing expanded flexibility under a new licensing model (*e.g.*, the potential for new users to co-exist in the band with incumbents);
- The nature and extent of investments made by incumbents in their acquisition of licenses and the building of systems, including whether incumbents have had the opportunity to recoup their investments; and
- The time and transaction costs associated with developing and implementing any particular transition mechanism in a particular band or bands, compared to other transition mechanisms.

New overlay licensing with mandatory relocation. As a preliminary matter, consideration of this option depends on the availability of alternative spectrum that would be suitable for use by incumbent licensees required to relocate. Assuming that alternative spectrum is available, this option may be preferred in cases where hand-clearing is likely to be critical because of the technical incompatibility between existing uses by incumbents and prospective uses. However, it is important that the benefits to be obtained through mandatory band-clearing outweigh the costs and time required to complete the relocation of incumbents, and that the relocation be consistent with the Commission's broader spectrum goals for the relocation band.

In order to ensure maximum efficiency gains in the near term and avoid holdout problems, it is preferable under this option for there to be a fixed timetable for mandatory relocation. Furthermore, this option is likely to work best when there are market incentives for new licensees and incumbents to negotiate voluntary relocation agreements, although it may also be appropriate to develop mandatory compensation mechanisms in the event that the voluntary ones prove inadequate.

New overlay licensing with incumbent grandfathering. The "overlay option" generally requires the presence of a significant amount of unlicensed "white space" that would lend itself to an overlay licensing scheme. This option also is likely to work best where there is a limited need to relocate incumbents to other bands and where incumbents have incentives to acquire rights to the surrounding white space, *e.g.*, in bands that are being converted from site-based to geographic area licensing and where incumbent uses and potential new uses are generally compatible. In considering use of this option, the Commission needs to assess the degree of risk that incumbents will hold out against transitioning to more flexible use, which could hinder the Commission's goals of enabling more efficient use of the spectrum.

New overlay licensing with voluntary band-clearing/restructuring. This option has potential advantages when (1) the new flexible rights regime being implemented represents a significant increase in flexibility over the legacy rules, and (2) this expanded flexibility is likely to lead to rapid changes in the market value and the actual use of the spectrum. In such cases, a simultaneous exchange mechanism may be the fastest and

most efficient means of enabling incumbents and potential new spectrum users to restructure and reassign spectrum rights **within** the band to facilitate new uses. In determining whether to employ this option, the Commission should compare the administrative costs and efficiency of implementing a simultaneous exchange mechanism with that of employing other transition options, particularly the option of granting expanded rights to incumbents discussed below.

Expanded rights granted to incumbents. This option has potential advantages where the practical impact of granting incumbents additional flexibility is limited or is likely to be gradual rather than immediate, in which case it is likely that the operation of secondary markets over time can effectively distribute these flexible rights so that efficiency gains can be achieved. **As** a practical matter, this option also requires that there be no “white space,” *i.e.*, that all spectrum in the band be previously assigned to incumbents (to avoid ambiguity as to who is entitled to additional rights). While granting incumbent licensees additional flexibility may allow for more immediate expansion of the availability of flexible rights licensing models, it also may raise equity issues relating to possible windfalls or unjust enrichment. The larger issue is whether such a policy would encourage parties to make future bids on presumably low-cost spectrum that is allocated for low-value uses and that has no flexibility, then petition for an expansion of those rights after acquiring the license. Accordingly, in considering this option, these equity issues will need to be balanced against the potential gains in administrative efficiency and the potential public benefits of providing additional flexibility to incumbents in the band.

Conclusions/recommendations. The Task Force recommends that the Commission undertake the following:

- Identify encumbered bands licensed under legacy command-and-control regimes that are suitable for transitioning to expanded flexible rights licensing models within the next five years –
 - Set a goal of identifying 100 megahertz of spectrum below 5 GHz for this transition phase.
 - Develop processes for determining which bands provide greatest opportunity for improving efficient use through adoption of expanded flexible rights licensing schemes.
 - Look for band “defragmentation” opportunities (*i.e.*, consolidating narrowband spectrum “slices”).
- Choose appropriate transition mechanisms for the different bands being transitioned –
 - Look for bands in which to test different transition mechanisms.
 - Promote policy and legislative changes to facilitate the conducting of two-sided auctions.
 - Encourage migration of compatible technologies into common band groupings.

Recommendations:

- Expand the use of both the exclusive rights and commons models, and move away from the command-and-control model, with limited exceptions.
- Transition legacy command-and-control hands to more flexible rules and uses to the maximum extent possible (whether under the exclusive rights or commons model), with only limited exceptions.
- Assess and re-examine Section 647 of the Orbit Act to consider permitting but not requiring, the Commission to utilize competitive bidding to resolve mutually exclusive applications for global and international satellite services. Take into account international concerns, including frequency coordination with Canada and Mexico and global harmonization of uses.
- Continue to dedicate some spectrum on a command-and-control basis for public safety use.
- Address additional public safety needs through alternative “safety valve” mechanisms to make spectrum is available to public safety in emergency situations when more capacity is needed.
 - Because some public safety spectrum use is characterized by intermittent “spikes,” public safety users should have flexibility to lease spectrum capacity that is available during lower-use periods to commercial users with a “take-back” mechanism when public safety use increases.
 - For major regional or national emergencies, additional public safety spectrum needs should be addressed through enhanced easement rights to non-public safety spectrum.
- Develop more flexible policy for addressing public safety spectrum needs, including leasingtake-back arrangements with commercial users and easement rights to non-public safety spectrum in major emergencies.

Transition Recommendations:

- For new spectrum allocations and the associated spectrum assignments, apply the following basic framework
 - Base choice of exclusive rights, commons, **or** command-and-control model in particular bands on factors previously identified.
 - Make underlay rights based on interference temperature a component of new spectrum allocations and assignments.
 - This does not require a constant interference temperature definition across all hands.
 - Clearly define access rights for opportunistic devices whether based on secondary markets, easements, or a combination of the two.
- For encumbered spectrum, identify bands that are suitable for initiating transition within the next five years and develop a transition plan for each band.
 - Set a goal of identifying highly valuable 100 megahertz of spectrum for this transition phase.
 - Look for band “defragmentation” opportunities (consolidating narrowband spectrum “slices” and encouraging migration of compatible technologies into common band groupings).
 - Interference temperature should be specified for most new allocations and associated assignments, and underlay operations.
 - Address underlay/easement rights in transition bands on a going-forward basis (avoid retroactive easements).
- Develop mechanisms to improve efficiency of secondary markets in facilitating transition
 - Move forward with the Secondary Markets proceeding.
 - Facilitate use of leasing, band managers, and similar mechanisms to promote transition, particularly in multi-use bands.
 - Address spectrum access issues in rural areas.
 - Recommend that Congress amend Section 309(j) of the Act to include an express grant of authority to the FCC to conduct two-sided auctions and simultaneous exchanges.
 - Recommend that Congress amend the Act to authorize the use of auction funds to pay relocation expenses to incumbents.
 - Recommend that Congress eliminate the 2007 expiration date on the Commission’s statutory auction authority and grant the Commission permanent auction authority

VIII. Promoting Access to Spectrum

A. Designating Spectrum Bands for Unlicensed Use

The currently available spectrum for unlicensed operations has spawned a significant market for unlicensed devices and, as a result, the Commission should consider designating additional bands for unlicensed use to better optimize spectrum access. It is estimated that sales of unlicensed consumer devices are more than \$2 billion per year. In addition, the growing popularity of computer networking has stimulated a heightened interest in unlicensed technology and one of the fastest growing applications of unlicensed devices is for WLANs. Among the more popular wireless data services are devices that operate in the 2.4 GHz band in accordance with the 802.11b or “Wi-Fi” standards and protocols developed by the Institute of Electrical and Electronic Engineers. Unlicensed devices are also being developed to provide very short-range wireless “personal area” networks (WPANs), such as Bluetooth. The wireless LAN market posted its eighth consecutive quarter of double-digit growth; total growth from 2000 has been over 150 percent.

Much of the spectrum below 50 GHz is available for low-powered unlicensed use. Higher-powered operations are permitted in several bands, however.⁴³ A significant number of parties stated that additional spectrum should be made available for unlicensed use. And, based on the record, it is generally perceived that the creation of unlicensed bands has been very successful in allowing the rapid introduction of new technology and that additional unlicensed bands would create more such opportunities. However, there was a general lack of information on how the Commission should create such unlicensed bands and what priority they should be given relative to other spectrum requests.

The Task Force finds that, while it is not practical at this point to develop estimates of the optimal amount of spectrum that should be provided for unlicensed operations, it appears that additional spectrum is needed for unlicensed devices. This is particularly true in light of recent trends towards increased use of short distance wireless systems, which use fixed infrastructure to provide end-to-end connectivity. In large area wireless systems, it has been difficult to control mutual interference without entry and technical regulation. As radio ranges become smaller, this justification for licensing becomes less universal. An ever increasing fraction of today’s radio applications have ranges measured in yards rather than miles. For new unlicensed bands, access should be controlled by a new type of band manager or frequency coordinator selected by the FCC.

In addition, while there is great interest in making available additional unlicensed spectrum, there is no consensus on how such spectrum should be obtained, especially at frequencies in the lower regions of the spectrum, *i.e.*, at 5 GHz and below. The Industrial, Scientific, and Medical (ISM)/spread spectrum bands were relatively easy to

⁴³ These bands include: 902-928 MHz; 1910-1930MHz, 2390-2483.5MHz, 5150-5350MHz, 5725-5825 MHz, and 57,000-64,000GHz.

designate for unlicensed use because the microwave ovens and other ISM equipment using them made these bands of little value to most traditional spectrum users. However, having used this opportunity, there is little “low-hanging fruit” left for unlicensed band use. As it considers any expansion of unlicensed use, the Commission will have to pay careful attention to legitimate concerns of other spectrum users and consider untraditional approaches to obtaining spectrum use. In spectrum above 50 GHz, however, the Task Force recommends that future rulemakings routinely review *de novo* whether licensing is in fact necessary.

The record also indicated that wireless ISPs (WISPs) often experience difficulty in tailoring their communications systems to meet particular needs due to the lack of flexibility in equipment authorizations. For example, WISPs may be unable to change antennas to suit a particular application, even though such change does not alter the operating parameters of the system. In addition, WISPs (and point-to-point systems) should be permitted to increase their power limits in rural areas. The Task Force recommends that the Commission facilitate increased flexibility for both systems and power limits, to the extent possible.

B. Secondary Market Rights and Easements

The record also suggests that there are ways to improve access to licensed spectrum by new entrants. As technological advances have increased the potential for spectrum to accommodate multiple non-interfering uses, two alternative and possibly complementary approaches have been suggested to facilitate access in licensed hands. Some commenters and Workshop participants advocated reliance on “secondary markets” arrangements involving the lease of spectrum usage rights. Under this approach, licensees would hold the rights associated with determining which potential entrants could have access to the spectrum and under what conditions. Other commenters and Workshop participants advocated allowing open access to licensed spectrum for non-interfering devices through expanded use of government-defined “easements.” In the latter case, the Commission, and not the licensee, would establish conditions for user access to the spectrum, and the consent of the licensee would not be required so long as the non-licensee user complied with the conditions.

Commenters disagreed, however, on how to balance these approaches. Proponents of secondary market arrangements asserted that the market can solve most types of access problems if licensees have flexibility and exclusive rights. Secondary markets proponents were also skeptical of the easement approach, arguing that (1) “non-interfering” operation tends to work better in theory than in practice, and (2) even where spectrum is otherwise not being used by the licensee, creating easements for third party access without the licensee’s consent could lead to squatter’s rights problems. Some commenters also argued that easement rights should not be created on spectrum that has already been licensed by the Commission, contending that incumbent licensees have already built out their systems and made other technical decisions in reliance on being able to control access by third parties that could possibly create harmful interference.

Proponents of easements asserted that requiring negotiation of access rights in the market would not facilitate, and might even inhibit, access by the very technology that is revolutionizing efficient spectrum use, *i.e.*, smart, frequency-agile devices. They pointed out that the Commission currently allows some unlicensed devices to operate in licensed spectrum without the users of those devices obtaining permission from the licensee. Easement proponents also contended that exclusive rights holders will prefer to block access by such devices to protect their investment, and that the only way to open spectrum to new uses is to vastly expand the use of the easement model. They also contended that new technology is sufficiently sophisticated to overcome concerns regarding interference with the licensed user's operations.

The Commission has already taken some steps to initiate and expand access to spectrum. For example, in the Secondary Markets proceeding, the Commission has begun to explore possible market arrangements that would give licensees greater flexibility to authorize others to use otherwise unused portions of their licensed spectrum. The Commission has also used an easement approach in cases such as UWB, but this is still a very limited application compared to the type of easement access that some commenters advocate. As discussed above, developments in new technology such as SDR, frequency-agile radios, and spread spectrum have heightened the importance of the access issue by making multiple dynamic uses of spectrum possible that were not technologically feasible in the past. The Task Force therefore recommends that the Commission develop access models that take this new technological potential into account. At the same time, these models must take into account the need for licensed spectrum users to have flexible and clearly-defined spectrum usage rights that promote efficient and beneficial spectrum use.

Going forward, the Task Force believes that there is room for the balanced and expanded use of both the secondary market and easement approaches to facilitate spectrum access. First, as discussed above, the Task Force recommends that in bands where an interference temperature threshold is established, the Commission use an easement approach to create spectrum usage rights for unlicensed devices that operate below the threshold.⁴⁴ An easement approach appears appropriate for these operations because by definition, the licensee is required to accept any RF energy that is created by such devices so long as the threshold is not exceeded.

Second, the Task Force recommends looking primarily at the use of secondary markets, but possibly at some limited use of easements as well, to facilitate access to licensed spectrum for opportunistic, non-interfering devices that operate above the temperature threshold. Under the secondary markets approach, licensees would have broad flexibility to allow secondary uses of their spectrum by devices operating above the interference temperature threshold. Such devices would operate as secondary users based on an agreement with the licensee, which can be negotiated directly with the licensee or through a private intermediary (*e.g.*, band manager or frequency coordinator) that manages the secondary uses on the licensee's behalf.

⁴⁴ See Sections VI and VII.B, *supra*.

In most cases of potential opportunistic use of spectrum, efficient secondary market mechanisms can be developed that would allow negotiated access at reasonable transactions costs. The secondary markets model takes advantage of the flexibility and adaptability of the market to solve access problems. Because licensees have economic incentives to use spectrum in ways that will yield the highest return to them, they will generally find it advantageous to allow others to use unused portions of their spectrum if they are adequately compensated.

The Task Force does not agree with commenters that contend that making an exclusive licensee the access “gatekeeper” (*i.e.*, requiring potential spectrum users to obtain licensee consent) will inhibit access by new technology, although there may be occasional instances of this type of restrictive behavior. If the rights afforded to licensees are sufficiently well-defined and flexible, and the secondary market mechanism is fast and efficient with low transaction costs, licensees will have ample incentive to negotiate with potential secondary users for such access. It is also important to realize that a secondary markets approach to access by opportunistic devices does not necessarily require the prospective opportunistic user to negotiate individually with each affected licensee: band managers, clearinghouses, and other intermediaries such as clearinghouses can facilitate these negotiated transactions. Thus, the secondary market approach has significant potential to foster opportunistic technologies, such as agile-frequency-hopping radios, software defined radios, and adaptive antennas, at reasonable transaction costs. In fact, it is anticipated that as the access-enhancing potential of these technologies continues to improve, exclusive licensees will often wish to encourage and even develop such technologies in order to provide new services and devices and serve more customers.

To facilitate use of the secondary markets model, it is essential to have in place a flexible and efficient regulatory regime that allows for the negotiation of the necessary access rights and keeps the transaction costs of negotiation low. To further this goal, the Task Force recommends as an essential first step that the Commission take action to adopt rules in the ongoing Secondary Markets proceeding, and that it take additional steps to implement secondary markets to the extent that its current statutory authority allows. In addition, to the extent that statutory constraints continue to exist, the Task Force recommends legislative changes that would provide explicit authority for the Commission to implement a fully flexible approach to secondary markets.

While the Task Force generally recommends that access rights for devices operating above the interference temperature threshold be negotiated through the secondary market, there may be instances where secondary markets work less well because they impose such significant transaction costs on parties that negotiations will not occur. In such cases, the easements model may offer a viable alternative approach. Under this approach, unlicensed devices operating above the interference temperature threshold would be allowed to operate on licensed spectrum on a non-interfering basis subject to specified conditions and with no negotiation with the licensee required. Non-interfering operation would be ensured by allowing operation at a higher power on a not-

to-interfere basis using standard protocols. The FCC or a frequency coordinator would administer and resolve harmful interference issues. By definition, the easements model allows for efficient and low-cost access to spectrum, because the government establishes overall rules and protocols under which any user would be allowed access to the spectrum, and negotiations with individual licensees are not required. The easements model also bears greater consideration than in the past because the increased sophistication of technology allows for the possibility of enhanced spectrum use by third parties on a non-interfering basis with the licensee.

Nevertheless, broad application of the easement approach to operations above the interference temperature threshold presents significant challenges. Because the easement model inherently limits the flexibility afforded to the licensee to some degree, and relies on government to define the scope of the easement, it should be applied cautiously. For example, currently all Part 15 devices are limited to extremely low power levels in order to minimize the possibility of interference. If opportunistic devices are to be authorized at higher powers in the future, this will require regulations or protocols to ensure that such devices have the ability to “listen” before they transmit and to cease transmitting instantly when continued transmission would cause interference. In addition, there is the concern that once unlicensed devices begin to operate in an easement, it may be difficult legally or politically to shut down their operations even if they begin to cause interference or otherwise limit the licensed user’s flexibility. Thus, as proponents of the secondary market model note, the potential for “squatter’s rights” issues to arise is another potential downside of the easement model that must be addressed.

To address these concerns, the Task Force recommends that in the first instance, the Commission focus on use of the secondary markets model to facilitate access above the interference temperature threshold. Once there has been an opportunity to evaluate the effectiveness of this approach, the Commission can then assess whether there is a need to pursue an easement approach for some types of access. Even then, any decision whether to use an easement approach will require careful consideration of the time, space, and frequency-agility dimensions of the proposed spectrum use. In addition, in making such decisions, the Commission will need to be sensitive to the potential impact of allowing easement-based access by opportunistic devices on the expectations, business plans, and investment made by licensed spectrum users.

C. Access to Spectrum in Rural Areas

The Task Force addressed the issue of whether the Commission’s approach to spectrum management should vary in different portions of the spectrum, in different geographic areas, or for different types of uses. Many commenters focused considerable discussion on the issue of rural areas, where spectrum is almost uniformly uncongested even in the most heavily used bands below 3 GHz. Although some parties indicated that the Commission should not adopt different spectrum allocation and assignment policies for different portions of the spectrum or different geographic regions, it was generally recognized that the economic and technical considerations in rural areas are different than in urban areas, and there is some support in the record for applying different rules to spectrum usage in urban and rural areas.

Some advocates for rural interests asserted that rural carriers have difficulty gaining access to spectrum, even though spectrum in rural areas is typically the least congested. Specifically, rural carriers argued that the Commission's tendency to use large geographic licensing regions that encompass both urban and rural areas discourages rural carriers from seeking to acquire licenses. In addition, rural carriers contended that the Commission's partitioning and disaggregation rules do not benefit rural providers because they must incur significant transaction costs to negotiate access to rural spectrum with multiple large carriers that may prefer in any event to retain such spectrum for future use. It was further argued that licensing build-out requirements that are based on population coverage tend to lead to build-out only in urban areas, with rural spectrum going unused.

Commenters also discussed whether there should be different interference standards for rural and urban areas. Certain parties advocated higher permissible power levels for rural areas on the theory that where there is less congestion, higher permissible power levels would allow for fuller usage of spectrum. Others objected to this idea, arguing that having different rural and urban regimes is impractical because it is not a simple matter to define urban versus rural, as many areas fall somewhere in between and problems may arise when formerly rural areas undergo development. Thus, there was a difference of opinion as to whether different technical rules for rural areas are feasible or desirable.

The Task Force recommends that the Commission explore ways to promote spectrum access and flexibility in rural areas. As a threshold matter, however, it is important to note that the distinction between high- and low-congestion areas does not necessarily require non-uniform rules for the latter, so long as the rules do not artificially cause spectrum congestion or constrain the use of uncongested spectrum. Interference and other technical rules should generally be calibrated to conditions in areas where spectrum is likely to be in the greatest demand and the most congested, which will typically be urban areas. Thus, the obligations of spectrum users to avoid interference should be set at levels suitable for such areas, as should their obligation to accept interference from others. However, these rules should also afford spectrum users the flexibility to operate at higher power in less congested areas, which are typically rural, so long as such higher power operations do not cause interference and do not receive additional interference protection. These same principles should be applied to unlicensed bands so that higher-power operation of unlicensed devices is permitted in less congested areas.

To improve providers' ability to gain access to spectrum in rural areas, the Commission should promote the development of an efficient and flexible secondary markets regime that, in addition to partitioning, facilitates the leasing of spectrum usage rights in rural areas, which would significantly lower transaction costs. The Commission could also consider expanding "easements" on licensed spectrum (as discussed in Section VIII.B. above) in low-congestion areas to allow access, on a non-interference basis, by other spectrum users. Such an approach, however, would require the use of technology

that is capable of measuring the level of spectrum congestion in the area and adjusting power accordingly.

In addition, when licensing by geographic area, the Commission should consider the impact of its rules on access to rural spectrum. In some instances, it may be appropriate to use licensing areas that distinguish between rural and urban areas so that rural interests can more readily acquire spectrum in the areas they serve. However, in other instances, larger spectrum areas may be beneficial to rural interests by allowing licensees to take advantage of economies of scale or scope based on regional or nationwide footprints.

D. Experimental Licensing

Section 303(g) of the Communications Act of 1934, as amended, (the Act) authorizes the Commission to provide for experimental use of frequencies and charges the Commission with encouraging “the larger and more effective use of radio in the public interest.”⁴⁵ Experimental licenses provide the opportunity for manufacturers, inventors, entrepreneurs, and students to experiment with new radio technologies, new equipment designs, characteristics of radio wave propagation, and new service concepts related to the use of the radio spectrum, which may not otherwise be permitted under existing service rules. In order to encourage innovation, the experimental license rules provide great flexibility with regard to allowable frequency range, power, and emission. However, to protect previously-allocated services, experimental licenses are issued on condition that experimental operations do not cause interference to existing services, and experimental operations are not protected from interference from allocated services.

Only a few parties addressed the topic of experimental licenses. The principal concern of these parties appeared to be potential delay involved in obtaining an experimental license due to interagency frequency coordination and, in particular, difficulties associated with testing systems being developed for government transfer bands and for overseas markets with different allocation plans. Concerns were also raised about the non-interactive nature of the coordination process from the point of view of private entities seeking to experiment with new technologies.

Experimental license applications that request use of spectrum used exclusively by the federal government or shared with the federal government must be coordinated with NTIA to assess any potential interference issues. In practice, NTIA refers such applications to the Interdepartmental Radio Advisory Committee (IRAC), which is composed of all federal agencies that are major spectrum users.⁴⁶ Most coordination requests are handled promptly, but some applications remain in the coordination process

⁴⁵ See Section 303(g) of the Communications Act of 1934, as amended, 47 U.S.C. § 303(g). This discussion is based in part on the NPRM in Docket 96-256, 11 FCC Rcd **20130** (1996). The rules addressing experimental licenses are contained in Part 5 of the Commission’s rules. See 41 CFR Part 5.

⁴⁶ NTIA coordination is actually carried out by the IRAC Frequency Assignment Subcommittee (FAS).

for a considerable period of time and, in some instances, are not resolved after periods in excess of one year.⁴⁷

The Task Force believes that a slight modification in the frequency coordination process may effectively facilitate expeditious resolution of any potential interference issues. A suggestion from the parties, that the Task Force supports, is to permit more direct communications between parties who have applied for experimental licenses and the federal government entities concerned about their pending experimental applications on a more regular basis. The parties suggest that such contacts would allow them to explore possible modifications in their experimental license applications that might lead to mutually acceptable outcomes, such as restricting location, operating power, and operating hours. Although the Task Force recognizes that classification issues related to certain federal government systems may make direct communication impractical in all cases, at least in some instances, communications between the parties is possible and that new procedural and organizational mechanisms should be put in place to improve communications between commercial parties desiring to implement experiments and federal users of the spectrum. To this end, the Task Force recommends that the FCC and NTIA consider implementing a new interface for non-federal government spectrum users with IRAC members to help search for workable compromises for experimental license applications. One possible approach, also suggested by commenters, would be to consider appointing an advocate or ombudsman for the private sector.

In addition, the Task Force believes that it would be helpful to have more information about the use of certain bands for experimentation – particularly government transfer bands -- available to the public. To facilitate experimentation in bands that are designated for transfer to the private sector, perhaps the FCC and NTIA could work together to identify – or pre-clear – some location, frequency, and time combinations where non-federal government spectrum users would be permitted to conduct experiments. These joint FCC-NTIA efforts would greatly facilitate the ability of the private sector to rapidly deploy consumer services in these bands after transfer from federal government use.

E. Transition Issues

As discussed, there are many ways to increase access to the radio spectrum. The Task Force recognizes, however, that these proposed changes cannot, and should not, be implemented without giving serious consideration to the reliance interests of incumbent spectrum users. Thus, for example, while the Task Force believes that it is important to conduct a review to determine which bands may be feasible for unlicensed use, it is equally important to assess and address the expectations of incumbent users in any candidate band.

There are few transition issues implicated in using the general secondary markets model to facilitate access to currently occupied spectrum, because access under this

⁴⁷ OET's Experimental Branch has recently instituted a procedure in which new applications that not successfully coordinated in one year are dismissed without prejudice.

model is premised on negotiation with the licensee. Licensed spectrum users would gain greater flexibility, and private negotiations would determine availability of particular spectrum for use by others. To the extent, however, that government-defined easements are contemplated as an alternative to the general secondary markets model, the issue of incumbency would be among the many serious challenges in deciding whether such easements would be appropriate.

Recommendations:

- Consider methods for additional spectrum access for unlicensed devices, which include:
 - Access to new band controlled by a new type of band manager or frequency coordinator.
 - Opportunistic or dynamic use of existing bands – through either cognitive radio techniques to find “white space” in existing bands or use protocols to get out of the way of primary users.
 - Underlay beneath primary users:
 - (1) Unlicensed devices operate below acceptable interference level (that is, operate on a non-interference basis with licensees); and/or
 - (2) Unlicensed devices can operate at higher powers if negotiate with licensee – negotiations can either take place directly or through private band manager.
- In licensed spectrum bands, pursue secondary markets policies that encourage licensees to provide access for “opportunistic” uses above the interference temperature threshold through leasing of spectrum usage rights.
 - At a later time, after evaluating the effectiveness of secondary markets approach, assess whether there is a need to create government-granted “easements” for some types of access, but consider the potential impact of this approach on planning and investment by licensed users.
- Millimeterwave bands: all future rulemaking for terrestrial use above 50 GHz should include *de novo* review of the merits of licensing.
- Wireless ISPs (WISPs) and point-to-point microwave systems:
 - Facilitate greater flexibility by making it easier for operators to better tailor their equipment for particular application.
 - Increase power limits for WISPs (and point-to-point systems) in rural areas
- In general, technical rules should be calibrated to areas where spectrum is in the greatest demand and the most congested, which are typically urban areas.
 - In less congested areas, the rules should not prevent licensees from operating at higher power on a non-interference basis, but licensees operating in such areas should not have expanded interference protection rights or reduced obligations to avoid interference.
 - In unlicensed bands, technical rules should allow for higher-power operation in less congested areas.
- The Commission should increase incentives and reduce transaction costs on parties seeking access to rural spectrum
 - Geographic licensing areas that distinguish between rural and urban areas may be appropriate in some bands to allow focused bidding on rural areas
 - More important is the development of an efficient and flexible secondary markets regime that facilitates leasing of rural spectrum in all licensed bands
 - The Commission could also consider expanding “easements” on licensed spectrum in rural areas to allow access by other spectrum users.
- Experimental Licensing: Recommend an interface with IRAC members to help search for workable compromises for experimental applications and suggest that NTIA or DOC to appoint an advocate/ombudsman for the private sector.
- Recommend that NTIA and FCC identify some (frequency, location, time) combinations in the transfer bands for experiments that have low risk of interference to Federal systems, “pre-clear” them and announce availability for experiments in a “broad area announcement”-like PN.

IX. Policy Recommendations

The following is a list of the Task Force's specific policy recommendations, which correspond to the recommendations listed at the end of each section. Specific recommendations that would require legislative action are listed in Appendix A.

A. Key Elements of New Spectrum Policy Recommendations

1. Permit broad, highly flexible use within technical parameters of the allocation,
 - a. Permit traditionally narrow services to lease excess capacity to other services.
2. Investigate rule changes that enable the lowering of permitted power in urban areas and the increasing of permitted power in rural areas.
 - a. Permit high-power digital television broadcasters to operate single frequency low power distributed transmission systems within their present service area.
 - b. Promote the co-location of high power transmitters.
3. Foster technologies for uniform signal strength generation throughout a service area.
4. Consider user fees or other steps to stimulate improvements in efficiency when marketplace is inadequate.
5. Promote shift to hybridizations with wireline delivery whenever appropriate,
6. Group future allocations based on mutually-compatible technical characteristics (power flux density and sensitivity to interference), and improve the out-of-band interference performance of transmitters and receivers over time so as to reduce the need for this kind of grouping.
7. Conduct periodic evaluations of allocation parameters with respect to evolving technology and uses.
8. Time-limit spectrum rights and subject them to periodic review
 - a. Every 5 to 10 years, review spectrum rights and obligations, interference criteria, and definitions, and modify if appropriate.
 - b. But spectrum users should be entitled to rely on rules remaining constant between periodic reviews.
 - c. Licensees should still have strong renewal expectancy.

B. Interference Avoidance Recommendations

9. Quantify acceptable levels of interference through "interference temperature" concept (long-term objective).
10. Obtain better data regarding noise floor:
 - a. Adopt standard method for measuring noise floor.
11. Create a public/private partnership for long term noise (interference temperature) monitoring network and archiving of data for use by FCC and public.

12. Include receiver tolerances in regulation (either through (1) additional incentives, (2) mandates, or (3) some combination of incentives and mandates) to be used until can migrate to “interference temperature” regulatory scheme and to be used for the long term where use of interference temperature would be inapplicable; *e.g.*, for systems in which licensees do not have control over receivers.
13. Move to interference-limited policies.
14. Issue Notice of Inquiry to characterize current and future receiver environments and to explore issues to consider, such as, performance parameters and protection for legacy receivers.
15. Award contractual study to evaluate receiver performance in current environment.
16. Promote voluntary receiver performance requirements through industry groups.
17. Consider incentives for use of advanced receivers.
18. Promote transmitter enhancements for interference control: (a) foster technologies that enhance uniform signal levels throughout a service area; (b) promote greater use of automated transmitter control systems; and (c) consider tightening out-of-band emission limits over time.
19. Improve communications on interference issues with public.
 - a. Harmonize interference language in FCC rules and affected international rules.
 - b. Ensure consistent and appropriate use of interference terminology.
 - c. Develop technical bulletins that explain interference rules for all radio services.
 - d. Develop best practices handbook.
20. Add language to the Act expressly allowing the Commission to establish rules or performance requirements for receivers.
21. “Interference temperature” concept should form the basis for better defining interference rights.
22. Accompany clearer interference definition with effective enforcement.

C. Spectrum Usage Models Recommendations

23. Expand the use of both the exclusive rights and commons models, and move away from the command-and-control model, with limited exceptions.
24. Transition legacy command-and-control hands to more flexible rules and uses to the maximum extent possible (whether under the exclusive rights or commons model), with only limited exceptions.
25. Assess and re-examine Section 647 of the Orbit Act to consider permitting, but not requiring, the Commission to utilize competitive bidding to resolve mutually exclusive applications for global and international satellite services. Take into account international concerns, including frequency coordination with Canada and Mexico and global harmonization of uses.
26. Continue to dedicate some spectrum on a command-and-control basis for public safety use.

27. Address additional public safety needs through alternative “safety valve” mechanisms to make spectrum is available to public safety in emergency situations when more capacity is needed.
 - a. Because some public safety spectrum use is characterized by intermittent “spikes,” public safety users should have flexibility to lease spectrum capacity that is available during lower-use periods to commercial users with a “take-back” mechanism when public safety use increases.
 - b. For major regional or national emergencies, additional public safety spectrum needs should be addressed through enhanced easement rights to non-public safety spectrum.
28. Develop more flexible policy for addressing public safety spectrum needs, including leasing/take-back arrangements with commercial users and easement rights to non-public safety spectrum in major emergencies.
29. For new spectrum allocations and the associated spectrum assignments, apply the following basic framework
 - a. Base choice of exclusive rights, commons, or command-and-control model in particular bands on factors previously identified.
 - b. Make underlay rights based on interference temperature a component of new spectrum allocations and assignments.
 - i. This does not require a constant interference temperature definition across all bands.
 - c. Clearly define access rights for opportunistic devices whether based on secondary markets, easements, or a combination of the two.
30. For encumbered spectrum, identify bands that are suitable for initiating transition within the next five years and develop a transition plan for each band.
 - a. Set a goal of identifying highly valuable 100 megahertz of spectrum for this transition phase.
 - b. Look for band “defragmentation” opportunities (consolidating narrowband spectrum “slices” and encouraging migration of compatible technologies into common band groupings).
 - c. Interference temperature should be specified for most new allocations and associated assignments, and underlay operations.
 - d. Address underlay/easement rights in transition bands on a going-forward basis (avoid retroactive easements).
31. Develop mechanisms to improve efficiency of secondary markets in facilitating transition.
 - a. Move forward with the Secondary Markets proceeding.
 - b. Facilitate use of leasing, band managers, and similar mechanisms to promote transition, particularly in multi-use bands.
 - c. Address spectrum access issues in rural areas.

- d. Recommend that Congress amend Section 309(j) of the Act to include an express grant of authority to the FCC to conduct two-sided auctions and simultaneous exchanges.
- e. Recommend that Congress amend the Act to authorize the use of auction funds to pay relocation expenses to incumbents.
- f. Recommend that Congress eliminate the 2007 expiration date on the Commission's statutory auction authority and grant the Commission permanent auction authority.

D. Promoting Access to Spectrum Recommendations

- 32. Consider methods for additional spectrum access for unlicensed devices, which include:
 - a. Access to new band controlled by a new type of band manager or frequency coordinator.
 - b. Opportunistic or dynamic use of existing bands – through either cognitive radio techniques to find “white space” in existing bands or use protocols to get out of the way of primary users.
 - c. Underlay beneath primary users:
 - i. Unlicensed devices operate below acceptable interference level (that is, operate on a non-interference basis with licensees); and/or
 - ii. Unlicensed devices can operate at higher powers if negotiate with licensee – negotiations can either take place directly or through private band manager.
- 33. In licensed spectrum bands, pursue secondary markets policies that encourage licensees to provide access for “opportunistic” uses above the interference temperature threshold through leasing of spectrum usage rights.
 - a. At a later time, after evaluating the effectiveness of secondary markets approach, assess whether there is a need to create government-granted “easements” for some types of access, but consider the potential impact of this approach on planning and investment by licensed users.
- 34. Millimeterwave bands: all future rulemaking for terrestrial use above 50 GHz should include *de novo* review of the merits of licensing.
- 35. Wireless ISPs (WISPs) and point-to-point microwave systems:
 - a. Facilitate greater flexibility by making it easier for operators to better tailor their equipment for particular application.
 - b. Increase power limits for WISPs (and point-to-point systems) in rural areas.
- 36. In general, technical rules should be calibrated to areas where spectrum is in the greatest demand and the most congested, which are typically urban areas.
 - a. In less congested areas, the rules should not prevent licensees from operating at higher power on a non-interference basis, but licensees operating in such areas should not have expanded interference protection rights or reduced obligations to avoid interference.

- b. In unlicensed bands, technical rules should allow for higher-power operation in less congested areas.
37. The Commission should increase incentives and reduce transaction costs on parties seeking access to rural spectrum
- a. Geographic licensing areas that distinguish between rural and urban areas may be appropriate in some bands to allow focused bidding on rural areas
 - b. More important is the development of an efficient and flexible secondary markets regime that facilitates leasing of rural spectrum in all licensed bands
 - c. The Commission could also consider expanding "easements" on licensed spectrum in rural areas to allow access by other spectrum users.
38. Experimental Licensing: Recommend an interface with IRAC members to help search for workable compromises for experimental applications and suggest that NTIA or DOC to appoint an advocate/ombudsman for the private sector.
39. Recommend that NTIA and FCC identify some (frequency, location, time) combinations in the transfer bands for experiments that have low risk of interference to Federal systems, "pre-clear" them and announce availability for experiments in a "broad area announcement"-like PN.

Appendix A: Legislative Recommendations

The Task Force recommends that the Commission consider the statutory proposals detailed below for submission to Congress. These recommendations resulted from a thorough examination of the current statutory structure contained in the Communications Act of 1934, as amended, as well as related laws. They are intended as a blueprint for working with Congress to effectuate a more flexible spectrum policy regime.

- **Initiate** a review of the potential use of spectrum fees for non-market based spectrum uses. **See** Section V.D.
- Request language in the Communications Act to clarify the scope of the Commission's authority to establish rules or performance requirements for all receivers. **See** Section VI.B.
- Consider amending Section 309(j) of the Communications Act to provide the Commission authority to conduct two-sided auctions and simultaneous spectrum exchanges. **See** Section VII.D.
- Support existing legislative measures that would amend the Communications Act to authorize the use of auction funds to pay relocation expenses to Federal government incumbents and suggest expanding such measures to include non-Federal entities. **See** Section VII.D.
- Undertake a review of Section 310 of the Communications Act to determine the feasibility of providing the Commission with additional flexibility to improve the operation of secondary markets and the processing of other transactions. **See** Section VIII.B.
- Assess and re-examine Section 647 of the Orbit Act to consider permitting, but not requiring, the Commission to utilize competitive bidding to resolve mutually exclusive applications for spectrum used for global and international satellite services. **See** Section VII.C.